VERIFICATION OF A TRANSLATION

I, Michael Wallace Richard Turner, Bachelor of Arts, Chartered Patent Attorney, European Patent Attorney, of 1 Horsefair Mews, Romsey, Hampshire SO51 8JG, England, hereby declare that:

I am knowledgeable in the English language and in the German language, and I believe the English translation of the attached document is a true and complete translation.

I hereby declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code and that such willful false statement may jeopardize the validity of any application based thereon.

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Moisture-repellent and air-permeable container and method of manufacturing same

The invention concerns a container, in particular a bag, for packaging bulk material such as cement.

The invention further concerns a device for producing containers, in particular bags, for packaging bulk material such as cement, comprising a cutting tool for cutting a carrier web into portions and a shaping tool for shaping a container from a respective one of the portions.

The invention also concerns a method of manufacturing containers, in particular bags, for packaging bulk material such as cement, in which a carrier web is cut into portions and each portion is formed into a respective at least one container wall substantially forming a container.

The invention further concerns a method of filling containers, in particular bags, with bulk material, in which the bulk material, in particular cement, is introduced into the open container by means of a filling connection and the container is sealed off with respect to the filling connection.

Cement and other bulk material is conventionally sold and transported in paper bags. In that case the cement is packaged in the paper bag as in a pack. The paper bag is obtained from a portion of paper web. The paper wall of the paper bag is slightly air-permeable and also moisture-permeable. A disadvantage with the known cement bags that, during the filling operation, the air which accumulates in the bottom region of the cement bags cannot escape sufficiently quickly and completely from the cement bag so that unwanted air spaces occur in the cement bag. In addition, particularly during storage of the cement bag, moisture can penetrate into the cement bag through the paper from the exterior. As cement bags are used in the open air, particularly when building houses, they are there frequently exposed without protection to the weather. It is

therefore necessary for the cement bags to be stored in protection spaces which are constructed especially for them, under shelters or in closed containers on the building site.

In devices for the production of cement bags from paper which can be part of complex manufacturing equipment, the paper web is cut into portions, from each of which a respective paper bag is folded. The cement is introduced into the folded paper bags while still open. In that case, air is enclosed between the paper bag and the cement, and that air cannot escape sufficiently quickly to permit dense filling. The only loose cement bag filling is a disadvantage as it occupies an unnecessarily large volume.

The object of the present invention is to provide an inexpensive container suitable for the packaging of bulk material such as cement.

In accordance with a second aspect another object of the present invention is to provide a device for the inexpensive manufacture of containers suitable for the packaging of bulk material such as cement.

In accordance with a third aspect a further object of the present invention is to provide an inexpensive method of manufacturing containers which are suitable for the packaging of bulk material such as cement.

In accordance with a fourth aspect yet another object of the invention is to provide a method of densely filling containers, in particular bags, with bulk material such as cement.

In its first aspect that object is attained by a container as set forth in the opening part of this specification, comprising at least one gas-permeable and moisture-repellent container wall which substantially forms the container and which has a carrier layer and a plastic layer having openings.

Both properties of the container wall, gas permeability and the moisture-repellent property, are provided in accordance with the invention by the at least double-layer configuration of the container wall comprising a carrier layer and a plastic layer having openings.

The moisture-repellent property of the container wall which is repellent in particular for moisture which acts on the container from the

exterior protects the bulk material packaged in the container from being soaked through.

The plastic layer has openings. The openings in the plastic layer however are so small that gas can admittedly flow through the plastic layer, preferably from the inside outwardly, but no moisture penetrates therethrough from the outside inwardly. Moisture is present in drop form in the ambient air. The drop size is also determined by the cohesion forces of the liquid forming them. So that moisture drops cannot penetrate through the openings in the plastic layer, the openings should not exceed a given maximum size. The maximum size of the openings should therefore be below the drop size. The plastic layer can be arranged on the carrier layer on the outside and on the inside. If the carrier layer is disposed on the plastic layer on the inside, the plastic layer also protects the carrier layer from moisture penetration therethrough from the outside. If the carrier layer is disposed on the plastic layer on the outside, that is to say it does not have direct contact with the bulk material, moisture can admittedly pass through the carrier layer from the outside but the bulk material nonetheless remains protected by the plastic layer, and dry. The carrier layer can therefore be arranged on the plastic layer on the inside or on the outside and it also does not necessarily need to be moisture-repellent itself so that the container wall is overall moisture-repellent.

The gas permeability of the container wall permits gas enclosed in the container to escape through the container wall and thus permits denser packing of the bulk material in the container.

The carrier layer is gas-permeable. That makes it possible for gas and in particular air to escape from the container and through the carrier layer. The carrier layer can be for example a paper layer or a textile fabric layer. In particular the paper layer should as thin as possible so that it is gas-permeable. It is also conceivable for the paper layer to be perforated. The gas can also escape through the openings in the plastic layer which is preferably arranged on the carrier layer on the outside but can also be arranged on the carrier layer on the inside. The container wall is thus

overall gas-permeable. Unwanted gas in the container can escape to the exterior.

The double-layer configuration of the container wall, in spite of its air-permeability, affords a high level of tearing strength. The thin nature or the perforation of the carrier layer admittedly reduces the tearing strength thereof, but it is required for the gas-permeability thereof. Those conflicting demands on the thickness of the carrier layer are satisfied here by the application of a plastic layer which is not closed but which nonetheless increases the level of tearing strength.

Basically it is also possible for a plurality of carrier layers to be arranged in mutually superposed relationship to form the container, with plastic layers arranged between them. That provides a particularly tear-resistant container wall.

In a particularly preferred embodiment of the invention the adhesive layer is a hot melt adhesive layer. The hot melt adhesive layer can be applied to carrier layers, in particular paper layers, for example in production equipment in the form which is required for the invention and which has openings. The hot melt adhesive layer having openings can be porous, it is even possible for the hot melt adhesive to be applied to the carrier layer in the form of a mesh or in stripes which are arranged in closely mutually spaced juxtaposed and preferably parallel relationship. Hot melt adhesive is relatively inexpensive and is commercially available in different kinds. The hot melt adhesive makes it possible to inexpensively provide containers which are adapted to differing requirements, for example in respect of tearing strength and weight.

In its second aspect the object of the invention is also attained by a device as set forth in the opening part of this specification, which has at least one coating tool for the application of adhesive to a carrier web, and which has at least one transporting tool for transporting the carrier web past the at least one coating tool.

The device according to the invention serves in particular for manufacture of the above-mentioned containers, in particular bags. The device has at least one coating tool which is intended to apply a non-closed

plastic layer to the carrier web. The at least one transporting tool serves for transporting the carrier web past the coating tool. In addition, there can be provided a plurality of deflection rollers and transporting rollers which correctly position the carrier web, in particular in the region of the coating tool. The device according to the invention is inexpensive and quick to construct because it is only the additional fitment of the at least one transport means and the at least one coating tool that is necessary. Both components are basically known for example from EP 0 568 812 A1.

In a preferred embodiment of the device the coating tool has a fluid applicator with a slot nozzle arranged at the carrier web side. Preferably the slot nozzle is subdivided into slot nozzle portions which can be supplied with liquid hot melt adhesive by individual pumps or groups of pumps associated with slot nozzle portions. The pumps are controllable by means of a control device. The coating tool permits an application of a stripe-shaped plastic layer to the carrier layer. In that situation the carrier layer is continuously moved past the fluid applicator and a hot melt adhesive stripe can be applied from each slot nozzle portion in the width of the portion, to the carrier web. If the hot melt adhesive flow to each slot nozzle portion is great, a great deal of adhesive is applied to the carrier web in relation to surface area and the layer of adhesive becomes thicker. The device can be operated to produce coated carrier webs for the containers at high speed.

In a further advantageous configuration of the device the coating tool has at least one dispersing tool for dispersing adhesive powder on to the carrier web and, in the transport direction of the carrier web, downstream of the at least one dispersing tool, at least one heating element for subsequently heating and for melting the plastic powder and for producing an adhesive layer having openings. With the correct metering effect, the application in powder form makes it possible to produce a porous adhesive layer on the carrier material. The carrier web can desirably be pre-heated in order thereby to promote good adhesion of the adhesive powder thereto. That device permits the manufacture of particularly reliably moisture-repellent plastic layers.

The coated carrier web can be cut by means of the cutting tool into portions which can be respectively shaped by means of the shaping tool to afford a container, in particular a bag.

The cement bag wall can be of a multi-layer nature to produce particularly strong cement bags. Strong cement bags can be necessary when a large amount of cement is to be accommodated therein. In a further embodiment of the device therefore arranged in the transport direction downstream of the at least one coating tool are laminating rollers for applying a further carrier web to the adhesive side of the coated carrier web. The second carrier web can be pre-heated prior to being brought together with the coated carrier web. In addition, for fixedly adhering the two carrier webs, it may be conducive for the carrier webs which have been brought together to be post-heated.

In its third aspect the object of the invention is further attained by a method as set forth in the opening part of this specification, insofar as a carrier web is coated with an adhesive layer having openings in order to produce an air-permeable and moisture-repellent container wall. The method according to the invention can be carried into effect in particular by the above-described device. In that case, the adhesive layer having openings is applied to the carrier web in particular by means of the slot nozzle of a fluid applicator. Preferably inexpensive hot melt adhesive is applied to the carrier web.

In its fourth aspect the object of the invention is further attained by a method as set forth in the opening part of this specification, insofar as air enclosed in the container escapes during the filling operation through the at least one gas-permeable and moisture-repellent container wall. The bulk material which is introduced into the container by means of a filling connection generally includes air. That included air can already escape through the walls of the container during the operation of filling it. The method according to the invention therefore permits dense packaging of the bulk material in the container.

The invention is described by means of preferred embodiments by way of example. In the drawing:

Figure 1 shows a cement bag according to the invention,

Figure 2 shows a view in cross-section through the cement bag of Figure 1 along line II-II,

Figure 3 shows a diagrammatic view of a device according to the invention for the manufacture of cement bags as shown in Figure 1,

Figure 4 shows a coating tool in a device as shown in Figure 3, and

Figure 5 is a diagrammatic section through a slot nozzle taken along line V-V in Figure 4.

The cement bag 1 shown in Figure 1 is a cement-filled cuboidal container having a gas-permeable and moisture-repellent cement bag wall 2. The cement bag wall 2 encloses the cement pack-like and it is folded at its top side and its underside.

The cross-sectional view shown in Figure 2, taken along line II-II in Figure 1, shows the double-layer configuration of the cement bag wall 2 of the cement bag 1. A carrier layer 3 arranged at the inside in the cement bag and comprising air-permeable paper is in contact with the cement in the bag. The carrier layer 3 however can also comprise air-permeable textile fabric. A porous hot melt adhesive layer 4 is applied to the paper layer 3 on the outside.

That hot melt adhesive layer 4 has openings 5 and it is of a very low weight of about 8 g/m^2: the openings 5 are of such dimensions that moisture cannot penetrate therethrough into the paper layer 3, but it nonetheless remains air-permeable. The cement bag wall 2 provided in that way is moisture-repellent and air-permeable.

The diagrammatic view shown in Figure 3 of a device for cement bags shows a first roll 6 with an unrollable, air-permeable paper web 7. The paper web 7 is transported past a fluid applicator 9 by way of direction-changing rollers or drive rollers 8. The fluid applicator 9 is arranged stationarily and is connected by way of a hose to a gear pump 10. The gear pump 10 supplies the fluid applicator 9 with liquid hot melt adhesive from a storage container 11. The amount of fluid applied to the paper web 7 per unit of surface area can be controlled by setting a reduced or increased

rotary speed for the gear pump 10. A further control option is afforded by setting the transport speed of the paper web 7.

The device shown in Figure 3 permits an application of the hot melt adhesive to the paper web 7, the application of adhesive having openings. The paper web 7 is pre-heated with a first heating element 12. The liquid hot melt adhesive is applied to the pre-heated paper web 7 by the fluid applicator 9. In that case the amount applied per surface area is so selected that a hot melt adhesive layer 13 having openings is produced on the paper web 7. The pre-heating effect promotes for example evaporation of the solvents of the liquid hot melt adhesive and slower setting. The hot melt adhesive can thus penetrate into the paper web 7 for longer and produce a firm join thereto. The coated paper web is then post-heated by a second heating element 14 in order to cause the hot melt adhesive to produce an even firmer join to the paper web 7. The coated paper web is then fed by way of deflection rollers 8 to a cutting tool 15 which cuts the coated paper web into portions 16 of equal size. The portions 16 are shaped to provide cement bag walls 2 and filled with cement.

The cement is introduced into the cement bag 1 by way of a filling connection (not shown). The cement bag is then closed. The air which is enclosed in the cement bag in the filling operation escapes through the air-permeable cement bag walls 2.

Figure 4 shows a diagrammatic view of a fluid applicator 9 suitable for application of the hot melt adhesive. Application of the hot melt adhesive is effected by way of a slot nozzle 17 which is arranged on the fluid applicator 9 at the paper web side. Figure 4 shows the fluid applicator with a heating element arranged upstream thereof in the transport direction. The paper web 7 is transported past the first heating element 12 and heated there. Arranged downstream of the first heating element 12 in the transport direction is a further deflection roller 8a which is also a drive roller. The paper web 7 is transported through a narrow gap between the further deflection roller 8a and the fluid applicator 9. The slot nozzle 17 permits the hot melt adhesive to be applied to the paper web 7. The hot melt adhesive layer 13 is air-permeable. The openings thereof however are

so small and are so far spaced from each other that moisture impinging on the layer from the outside cannot penetrate therethrough into the paper web 7. The paper web 7 coated with the hot melt adhesive layer 13 is further transported by way of deflection rollers 8 and is further processed as already described with reference to Figure 3 to provide cement bags.

Figure 5 shows a diagrammatic section taken along line V-V in Figure 4. The slot nozzle 17 is arranged above the paper web 7. The slot nozzle 17 tapers perpendicularly to the plane of the drawing towards the edge at the paper web side. The slot nozzle 17 has slot nozzle portions 18a, 18b of differing lengths which are separated from each other by intermediate walls 19, along the longitudinal direction of the slot nozzle. The slot nozzle portions 18a, 18b are only connected together along their outermost edge towards the paper web. Each of the slot nozzle portions 18a, 18b can be supplied with liquid hot melt adhesive by way of a respective C-shaped passage 20 at its outer ends in the longitudinal direction of the slot nozzle. Some adjacent C-shaped passages 20 can be supplied together through common passages 21. Each of the common passages 21 has a gear pump 10 which is controllable centrally by way of a control device 22. The control device 22 makes it possible for the individual slot nozzle portions 18a, 18b to be controllably supplied with hot melt adhesive by the associated gear pump 10. The flow of the hot melt adhesive is metered in such a way that the hot melt adhesive layer applied to the paper web 7 is not closed, that is to say it has openings. The described slot nozzle 17 permits application of the hot melt adhesive to the paper web 7, in stripe form. In that case, associated with each of the slot nozzle portions 18a, 18b is a stripe to be applied, of the width of the associated portion 18a, 18b. In Figure 5 the paper web 7 moves along below the slot nozzle 17 in perpendicular relationship to the plane of the drawing. The stripes are consequently formed along the paper web 7 also in perpendicular relationship to the plane of the drawing.